Docket No: MS1-1070US
Inventor(s): Jered Aasheim, et al.
Title: Dynamic Data Structures for Tracking Data Stored in a Flash Memory Device
Replacement Sheet

100

102   DATA AREA 103   SPARE AREA   104

BLOCK 0
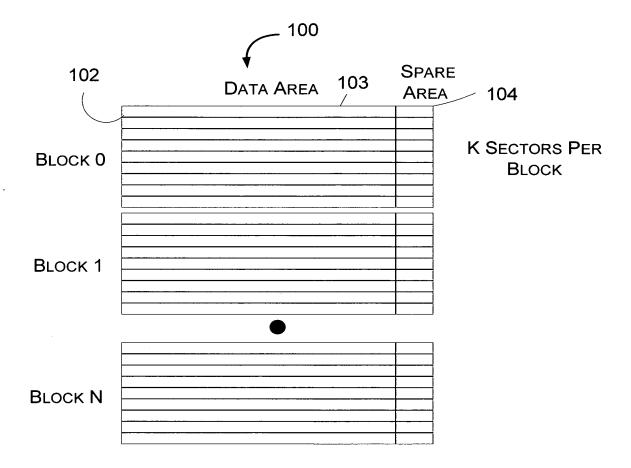
BLOCK 1

BLOCK N

K SECTORS PER BLOCK

Fig. 1

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─200

BLOCK 0

BLOCK 1

●

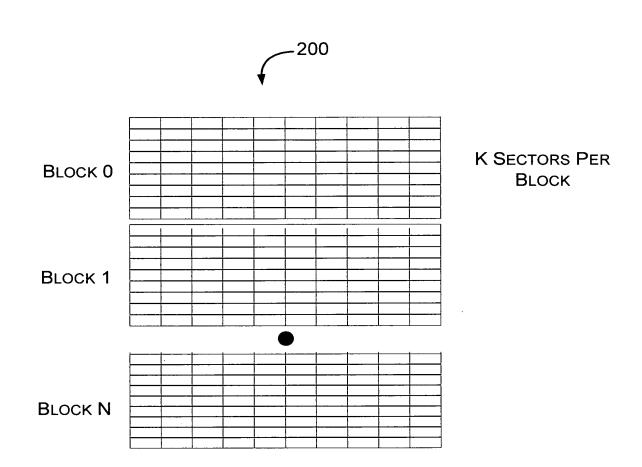BLOCK N

K SECTORS PER
BLOCK

Fig. 2

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300

COMPUTER DEVICE

PROCESSOR — 302

304 — MEMORY

APP(S) — 307

OS — 309

FILE SYSTEM — 305

FLASH DRIVER

FLASH ABSTRACTION LOGIC — 308

306

PROGRAMMABLE FLASH MEDIUM LOGIC — 310
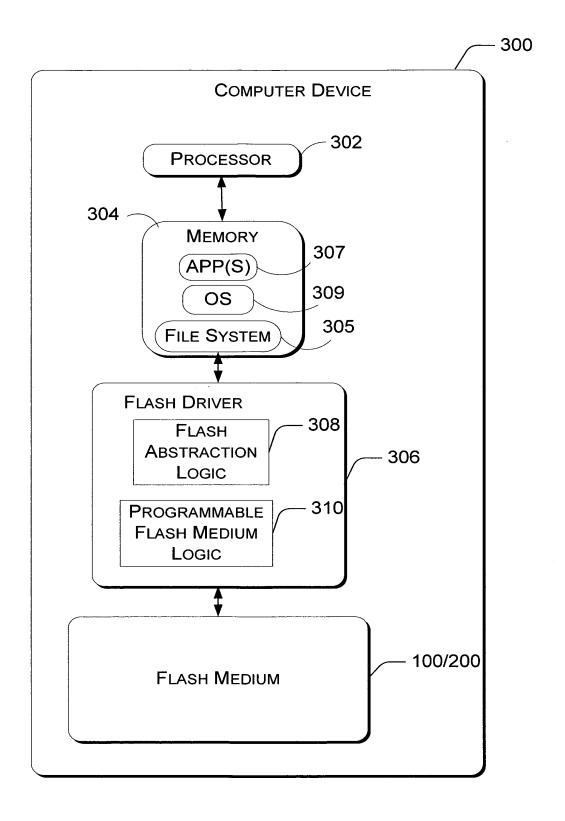
FLASH MEDIUM — 100/200

Fig. 3

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308

SECTOR MANAGER 402	LOGICAL-TO-PHYSICAL SECTOR MAPPING 404	COMPACTOR 406

Fig. 4

310

PROGRAMMABLE ENTRY POINTS 502	I/O [READ, WRITE, ERASE] 504	ERROR CODE CORRECTION 506

Fig. 5

600A

PHYSICAL SECTOR 602	LOGICAL SECTOR 604
0	11
1	12
2	36
3	
.	
.	
.	
N	

Fig. 6A

600B

PHYSICAL SECTOR	LOGICAL SECTOR
0	11 DIRTY
1	12
2	36
3	11
.	
.	
.	
N	

Fig. 6B

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700

RECEIVE A REQUEST TO WRITE DATA TO A LOGICAL SECTOR ADDRESS OF A FLASH MEMORY MEDIUM ⎯ 702

↓

ASSIGN A PHYSICAL SECTOR ADDRESS TO THE LOGICAL SECTOR ADDRESS FORMING A CORRESPONDING RELATIONSHIP ⎯ 704

↓

STORE THE CORRESPONDING RELATIONSHIP IN A TABLE ⎯ 706

↓

WRITE THE DATA INTO A PHYSICAL SECTOR OF THE FLASH MEMORY MEDIUM AT A LOCATION INDICATED BY THE PHYSICAL SECTOR ADDRESS ⎯ 708

↓

RECEIVE A REQUEST TO REWRITE UPDATED DATA TO THE LOGICAL SECTOR ADDRESS ⎯ 710

↓

ASSIGN A NEW PHYSICAL SECTOR ADDRESS TO THE LOGICAL SECTOR ADDRESS FORMING AN UPDATED CORRESPONDING RELATIONSHIP ⎯ 712

↓

STORE THE UPDATED CORRESPONDING RELATIONSHIP IN THE TABLE ⎯ 714

↓

WRITE THE UPDATED DATA INTO A PHYSICAL SECTOR OF THE FLASH MEMORY MEDIUM AT THE LOCATION INDICATED BY THE NEW PHYSICAL SECTOR ADDRESS ⎯ 716

↓

MARK THE PHYSICAL SECTOR ADDRESS FROM STEP 704 AS "DIRTY" ⎯ 718

Fig. 7

Docket No: MS1-1070US
Inventor(s): Jered Aasheim, et al.
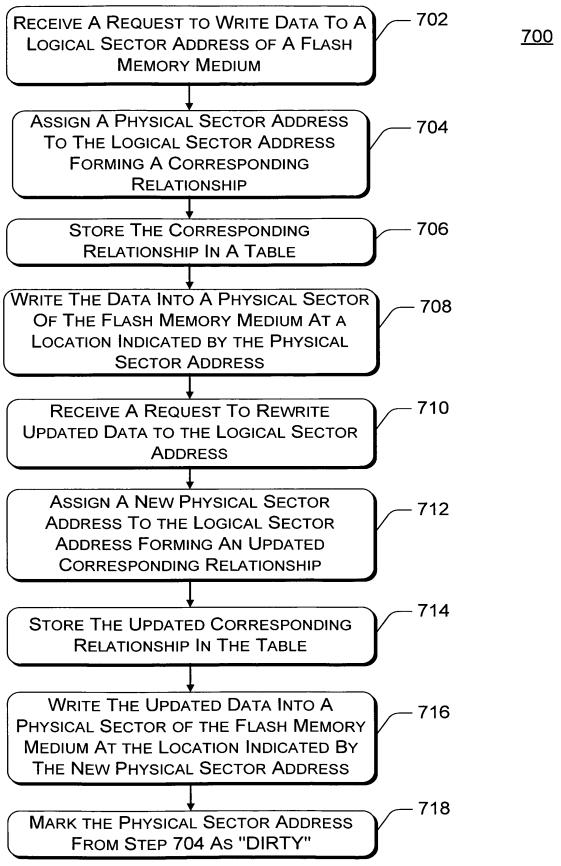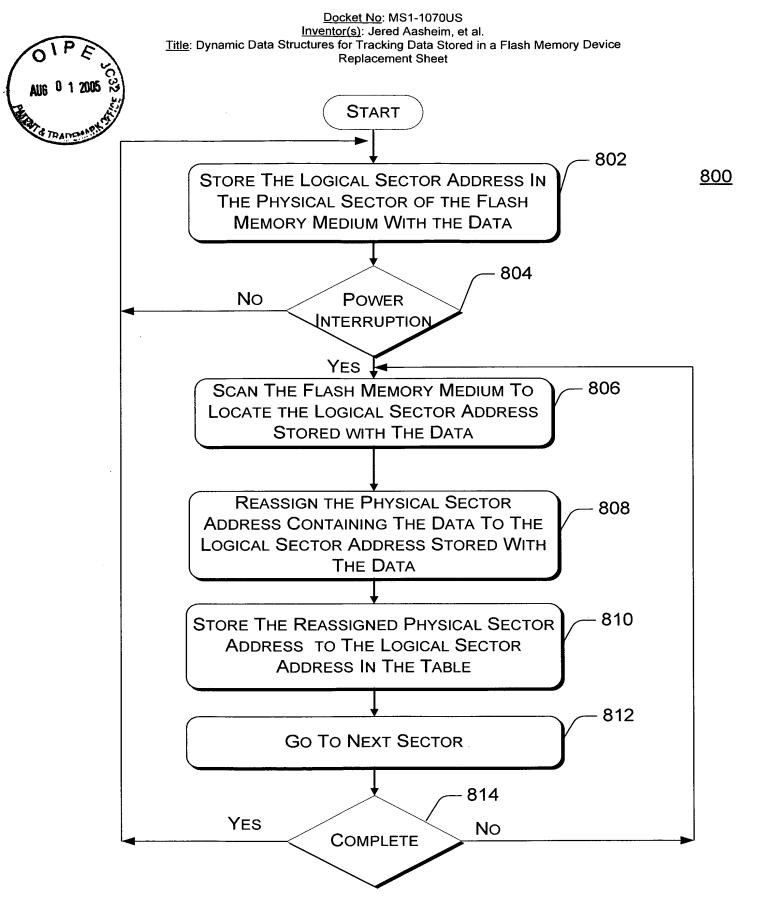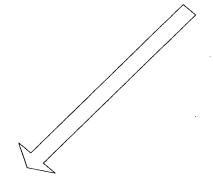Title: Dynamic Data Structures for Tracking Data Stored in a Flash Memory Device
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START

800

STORE THE LOGICAL SECTOR ADDRESS IN THE PHYSICAL SECTOR OF THE FLASH MEMORY MEDIUM WITH THE DATA — 802

No ← POWER INTERRUPTION — 804

YES

SCAN THE FLASH MEMORY MEDIUM TO LOCATE THE LOGICAL SECTOR ADDRESS STORED WITH THE DATA — 806

REASSIGN THE PHYSICAL SECTOR ADDRESS CONTAINING THE DATA TO THE LOGICAL SECTOR ADDRESS STORED WITH THE DATA — 808

STORE THE REASSIGNED PHYSICAL SECTOR ADDRESS TO THE LOGICAL SECTOR ADDRESS IN THE TABLE — 810

GO TO NEXT SECTOR — 812

YES ← COMPLETE → No — 814

Fig. 8

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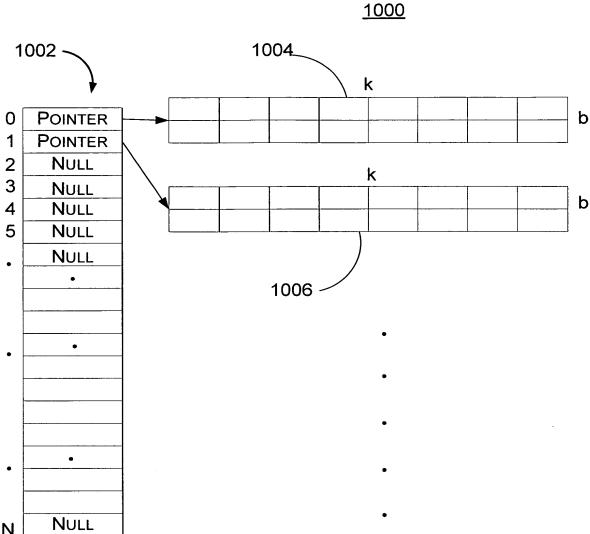Replacement sheet

SECTOR

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

Fig. 9

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Inventor(s): Jered Aasheim, et al.
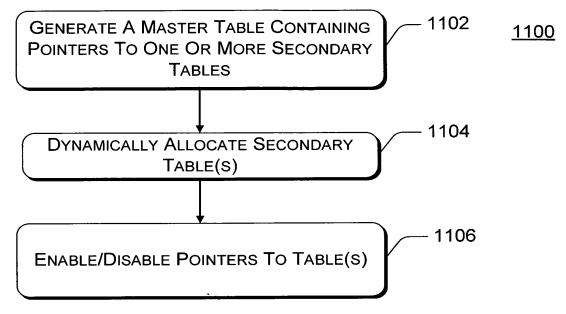Title: Dynamic Data Structures for Tracking Data Stored in a Flash Memory Device
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1000

1002
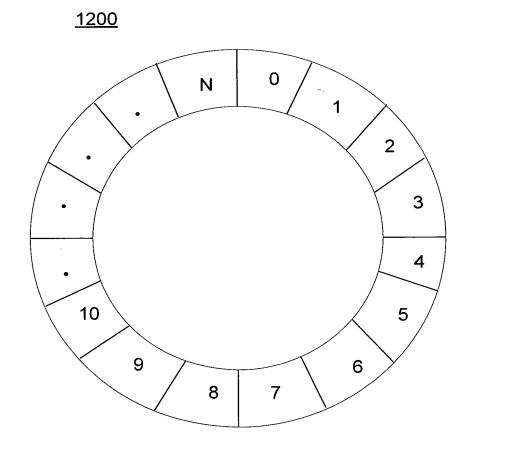
1004

k

1006

0	POINTER
1	POINTER
2	NULL
3	NULL
4	NULL
5	NULL
.	NULL
	.
.	.
.	.
N	NULL

b

k

b

Fig. 10

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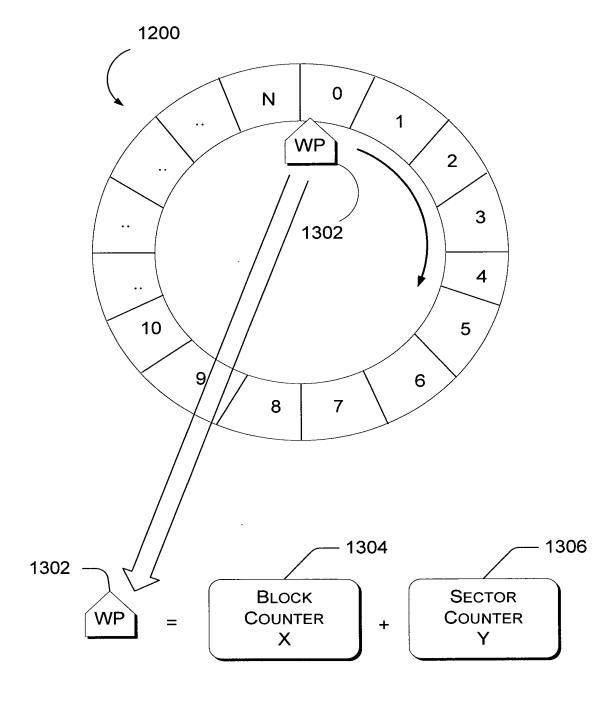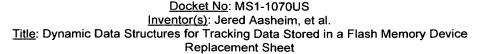Replacement Sheet

GENERATE A MASTER TABLE CONTAINING POINTERS TO ONE OR MORE SECONDARY TABLES ⎯ 1102

1100

DYNAMICALLY ALLOCATE SECONDARY TABLE(S) ⎯ 1104

ENABLE/DISABLE POINTERS TO TABLE(S) ⎯ 1106

Fig. 11

1200

Fig. 12

Docket No: MS1-1070US
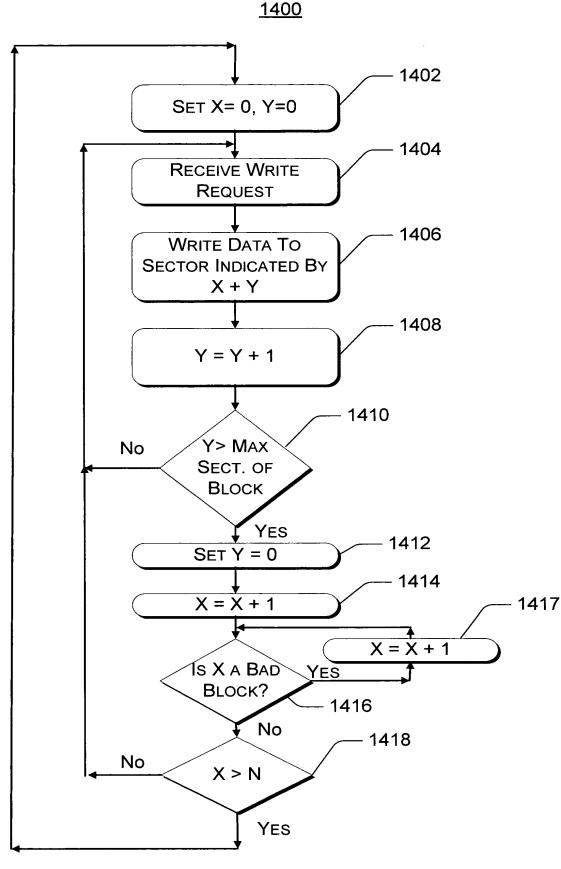Inventor(s): Jered Aasheim, et al.
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1200

N 0 1 2 3 4 5 6 7 8 9 10 ..

WP

1302
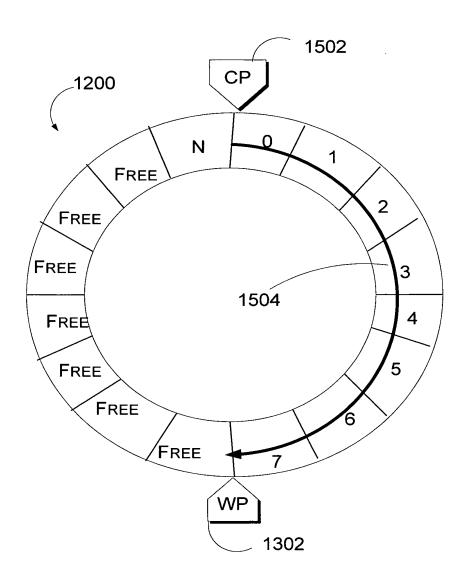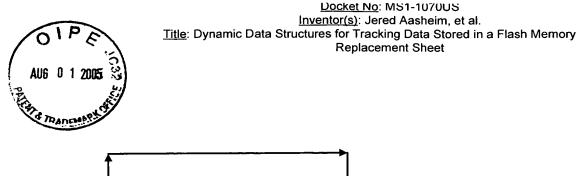
1302 WP = BLOCK COUNTER X + SECTOR COUNTER Y

1304 1306

Fig. 13

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1400

Fig. 14

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1502

CP

1200

N

0

1

2

3

4

5

6

7

FREE
FREE
FREE
FREE
FREE
FREE
FREE
FREE

1504

WP

1302

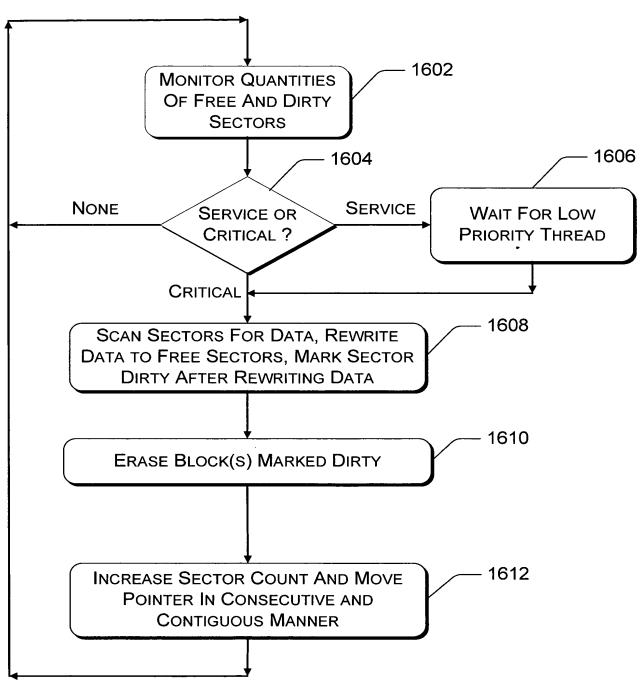Fig. 15

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1600

MONITOR QUANTITIES
OF FREE AND DIRTY
SECTORS
— 1602

— 1604

NONE ◁——— SERVICE OR
CRITICAL ? ————▷ SERVICE ———▷ WAIT FOR LOW
PRIORITY THREAD
— 1606

CRITICAL

SCAN SECTORS FOR DATA, REWRITE
DATA TO FREE SECTORS, MARK SECTOR
DIRTY AFTER REWRITING DATA
— 1608

ERASE BLOCK(S) MARKED DIRTY
— 1610

INCREASE SECTOR COUNT AND MOVE
POINTER IN CONSECUTIVE AND
CONTIGUOUS MANNER
— 1612

Fig. 16

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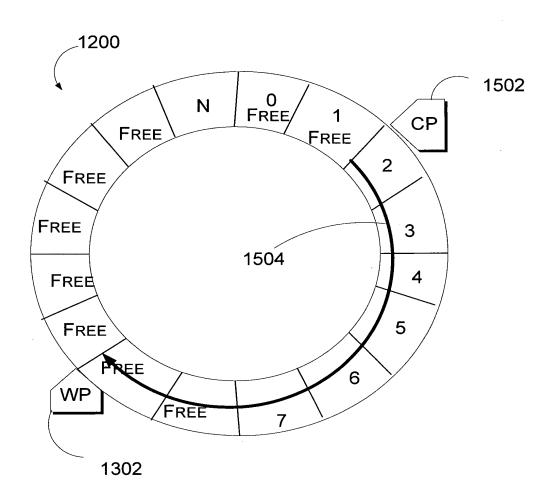
Fig. 17

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Replacement Sheet

200
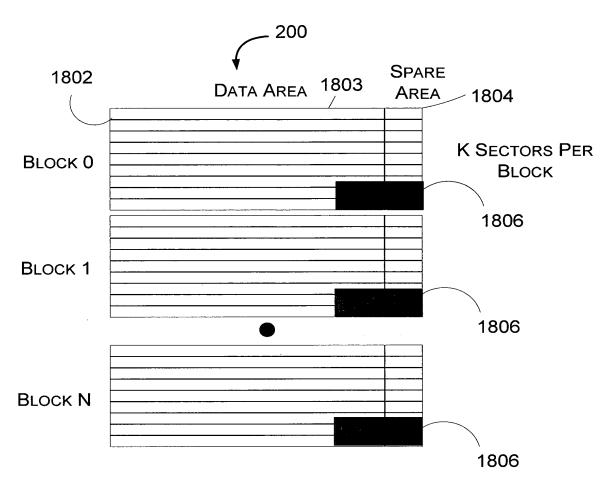
1802

DATA AREA 1803

SPARE
AREA 1804

BLOCK 0

K SECTORS PER
BLOCK

1806

BLOCK 1

1806

BLOCK N

1806

Fig. 18